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SPECIALISTS COPE WITH A BLESSING'S CURSE



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The oil and gas industry provides plenty of work for hydrogeologists.

Being insoluble, oil pools on top of groundwater, in a process known as hydrodynamic entrapment. Geologists who understand the properties of ground water can locate those pools and determine their extent and economic potential.

But hydrogeologists are also in demand at the other end of the petroleum industry spectrum -- for after the product has been refined and distributed.

If spilled, the petroleum products once again seek out ground water on which to pool, and by which to travel, but this time the products are far more dangerous to the environment.



Enter John Miller and his federal and YTG colleagues. "Our part of it is the overlooked

Not all oil spills are accidental. This pool was the result of repeated waste-oil dumping.

(photo: John Miller)

consequences of over consumption of oil, our massive use of it," says Miller. "Everybody talks about CO₂ emissions, but there is also quite significant ground-water contamination from the use of oil and derivatives."

Miller, who previously worked as a consultant in Toronto and several other large cities on the business side of spill management, took a job with Environment Canada two years ago. He then moved to Whitehorse where he serves in the pollution abatement division as a senior environmental scientist.

Obviously, he was in for a bit of a shock. "In Toronto you're talking hundreds and thousands of underground and above-ground storage tanks and kilometres and kilometres of pipelines everywhere, and tanker trucks full of oil, gasoline, diesel, jet

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fuel and heating oil... "

What he had experienced there was a far cry from nearly pristine, yet vulnerable Yukon. "I've realized how sensitive the environment is up here to these inputs," he says.

The fact is, accidents happen. "It is the cost of doing business," he says. "That's just a way of life in industrialized nations." Both government and business accept that and usually co-operate to mitigate the problems.

When we think of oil spills, we tend to think of tankers breaking open during storms at sea, pipelines that prove vulnerable to terrorists, and big tanker trucks flipping over beside salmon spawning streams, but those are the exceptions, Miller says.

The more common crises are far less dramatic.

Because we have no refineries in the territory, we rely on storage facilities so we can keep our industry and vehicles in motion, and our buildings warm. Out of sight and out of mind, a slightly flawed heating oil tank can wreak slow, but inevitable, havoc.

"The tank's been there for 10 years. It has a little pin-prick hole. That tiny hole could be dripping maybe a millilitre of oil every minute, just one little millilitre -- and so it goes for 10 years and ends up being 5,000 litres of product just spilled into the ground."

"That's quite significant and can contaminate a very large portion of ground and can lead to even more extensive contamination of ground water."

Depending on its location and extent, cleaning up a spill can be a complex and expensive proposition, he says.

First on the scene would likely be an enforcement team whose primary concerns would be immediate containment of the spill and to determine the source.

Typically, a responsible company would hire a consultant to arrange a more extensive clean-up response.

"Once the company has been doing their remediation, their clean-up, I'm brought in to see if they're looking at everything, if the clean-up is going properly."

"I'll be assessing what kind of potential impact there is to the environment, the groundwater and any fish-bearing waters."

"Once it goes below the ground's surface, that's my territory. Leaking petroleum infiltrates into the ground due to gravity, and infiltration from rain or snow melt pushes it further into the ground and it hits the water table."

"So from the source to the ground water you have all this contaminated soil that's

just full of petroleum product, whatever it is."

One remediation scenario for petroleum-contaminated soil involves land farms and some hard-working microbial colleagues. "Basically what you do is dig up all the contaminated soil and build a land-treatment facility. What you try to do is get oxygen going into the material to stimulate microbial activity."

"A bio-pile is essentially the same as a land farm, but you add a nutrient, something to meet the nutritional requirements of the bacteria. You give them an energy source and they get all excited and build up their populations and start the biodegradation of the oil as well."

Though the process can take far longer in the cold North, 10 years say instead of two to the south, it is possible to reclaim the soil after the bacteria have done their work. Such remediated soil is often used as fill if it meets the concentration standards for its intended use.

Sometimes, it's not possible to get at the contaminated spill directly, as when it lies beneath a massive building. "So you basically try to pump out as much of the contaminated ground water as you can. In some instances this is referred to as a multiphase extraction system."

"What you are doing basically is extracting the product, applying a vacuum, and introducing oxygen to help the bacteria."

Meanwhile, with monitoring wells planted in the ground water table of a spill area technicians are able to determine the concentrations of troublesome products and the range of the impacts.

Refined petroleum is far different from crude oil, which has often been sitting peacefully beneath healthy ecosystems for millions of years. The refining process will, for instance, add oxygenates, such as tetraethyl lead (banned for cars, but still used in airplane fuel) or MTBE (methyl tertiary butyl ether), a suspected carcinogen.

These compounds improve the octane rating of a fuel.

"They keep coming up with things that are better for the engines," says Miller. These things can be deadly to plants, invertebrates and fish and the creatures that feed off them. "It goes through the chain. Your top-chain predators will end up accumulating more of the materials."

Of course, it's in everyone's interest to act quickly and work thoroughly when such toxicants enter the soil and ground water. "It ends up somewhere," he says. "Usually back in us."





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